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WAGE STATISTICS IN THEORY AND PRACTICE.

BY ROLAND P. FALKNER.

“Consumption and production, wages, prices charged by mechanics, small traders, carriers, etc., are susceptible only of estimates.”¹ This dictum of Meitzen, particularly in its application to wages, has been a stumbling block to several writers. Yet it is, from a theoretical point of view, true in the vast majority of cases; and if we would understand the nature of wage statistics and their limitations we cannot do better than study this statement.

The author is opposing statistics and estimates, and this contrast is rigorously upheld by continental authorities.² The essence of the distinctions is that “statistics,” properly so-called, embrace directly *all* the phenomena within a given field, while all partial enumerations are estimates. For example, if the problem were to discover the wages of carpenters in Pennsylvania we should have “statistics” when we had combined, in whatever fashion, records of the wages of every carpenter in the State. Anything less than this, such as the choice of representative workmen in representative localities, might, indeed, give us very interesting figures capable of throwing much light upon the subject; but these figures would be “estimates” not statistics. In short, Dr. Meitzen does not pretend that every record of wages paid to individuals, such as appears in the monographs of the Le Play

¹ *History, Theory, and Technique of Statistics*, by August Meitzen, translated by R. P. Falkner, p. 183.

² In a somewhat similar discussion at the meeting of the International Institute at Bern, 1895, Professor Rauchberg of Prague voiced an opinion which I found to be very general when he said: “We must distinguish between statistics comprising the totality of cases and those which consider only types arbitrarily chosen. If we confine ourselves to the latter, the results will serve only for that part of the whole which these types represent, and they may not be adapted even to this. As to which of these this principle is preferable no one can be in doubt . . . the first system is statistics, the other is not” (*Bulletin de l'Institut International de Statistique*, 1896, vol. ix, part ii, p. xcv). Dr. Rauchberg informed the writer at that time that the Austrian Bureau had in contemplation wage statistics, and that they proposed to carry their principle into practice by securing the wages of every workman in each class in any geographical region to which the figures might relate.

School, and even in somewhat larger fields of observations, are estimates, but that what are generally called statistics of wages, which pretend to give the wages in a given industry in Great Britain or any larger geographical unit, are estimates. To take an illustration nearer home, the wages recorded in the Aldrich Report are not estimates, but they are not statistics; hence their combination to give a general view of the course of wages in the United States is an estimate. When in the last issue of these publications Mr. Bullock cites the work of Mr. A. L. Bowley to refute the erroneous opinion of Meitzen he only supports the latter, for Mr. Bowley's excellent study of "Changes in Average Wages in the United Kingdom"¹ is based upon statements of wages paid in particular localities.

To push the distinction between theory and practice to the point of declining to speak of wage statistics does not seem to me under ordinary circumstances a very profitable undertaking. Language is ever stronger than the theorist, and so long as everybody continues to speak of statistics of wages it would savor of pedantry to insist that they were not in fact statistics at all but mere wage records. Yet if there is a distinction between the requirements of strict statistical theory and the methods employed in obtaining results, which statisticians and economists regard as satisfactory, it imports to know what the distinction is and just how far it furnishes a criterion of judgment which enables us to reject certain results as inadequate and accept others as satisfactory.

Statistical inquiry into wages has concerned itself with two things,—the wages at a given period and the course of wages.²

¹ *Journal of the Royal Statistical Society*, 1895, pp. 233.

² Insistence has been laid by some writers, notably Mr. Wright, on the advantages of the classified wage table. As we shall hereafter deal almost exclusively with average wages it may be well to point out here how they are related. In actual wages we may be interested in the average wage or in the range of wages. In the latter case the classified wage table is the most apt expression of the facts. If Mr. Wright has emphasized this form of expression as a notable achievement of American statistics, it is because he opposes such a classified statement of wages to the generalities which masquerade under the name of averages but which rest upon no scientific method. The validity of the average if properly attained, and its usefulness as the briefest expression of a complex mass of facts, is fully recognized by Mr. Wright. (See his article, "The Evolution of Wage Statistics," *Quarterly Journal of Economics*, January, 1892.)

It is obvious that if the first be correctly determined the second task becomes an easy one. But given such data as we actually possess the problem is more complex.

We must therefore inquire whether the actual data at our disposal conform to the strict requirements of statistical theory, and in the absence of such conformity how far they may be regarded as accurate. In theory there are many striking analogies between the statistics of wages and prices. As I have already treated the subject of price statistics in these *Publications*¹ I shall be as brief as possible in this division of my subject. What then are the requirements of statistical theory in the matter of wage statistics? They are very simple. Within the geographical unit to which the figures relate the wages of each workman in the occupation considered must be recorded. All the rest is a matter of tabulation. Whether we deem the average wages the best statistical expression of the facts, or the classified wage table more adequate, will depend upon our immediate purpose. Our data will permit either arrangement, but they must be complete. If they are thus complete, if every workman of this occupation is included and no workman of other occupations are included, then none can question the accuracy of the average wages thus obtained. If statements of average wages are contested it can only be because they are not gained in this way and that the method employed is an inefficient substitute for it. Or we may go a step further and make an industry instead of an occupation the basis of our statistics. If all the workmen in the industry within the given geographical unit are enumerated we shall be able to calculate the average wages in the industry beyond the peradventure of a doubt. And if there was any object in finding the average wages in Philadelphia as compared with Reading it could be done without any criticism as to method if the wages of every wage earner in each locality were known. Whether such computations of average wages would be use-

¹ "The Theory and Practice of Price Statistics," vol. iii, 119 *et seq.*

ful would depend on the object of our inquiry. They would only show that different industries or different localities employed a higher or lower priced labor, whether by paying different rates or employing different grades.

Now, if we turn to the actual statistical data on wages, what do we find? Anything but the conditions above described. Either we find general statements which purport to give the average wages in certain occupations, or else figures of actual wages based on limited field of observation. In the latter case, for instance, we might find statistics of carpenters' wages in Philadelphia based on the wages of only a fraction of the workmen in occupation, and if we find statistics of such wages for the State they would in all probability be based on a comparatively small number of places. I have no fault to find with the facts. If practice differs from theory it is only because practical necessity has forced us into short cuts to reach approximately the same results as would be attained by the more cumbersome procedure which theory demands. Our study of actual wage statistics must concern the measure of this approximation and the methods which it uses.

Our interest in wages may attach to two things, wage rates or earnings. While they are frequently confused in popular writings I think statisticians are generally agreed that when wage statistics are alluded to the expression refers to wage rates. Whether such a consensus of opinion is universal or not it will avoid the possibility of misunderstanding to state that in this discussion wages and wage rates are considered identical terms.

In the earlier economic literature statements relating to wages usually took the form that wages of farm hands in England were so many shillings. If this meant anything at all it meant an average wage, and as such it was accepted wherever used. Investigation frequently revealed that in its original form it purported to be the average rate in a particular district, say Devonshire, and that its extension to

England was the work of a later writer. But what validity had such a figure with regard to Devonshire? Generally such statements are entitled to the weight of expert testimony. This assumes the informant to be well acquainted with the field, to have knowledge of the varying rates of remuneration and of the number who receive these rates. Provided the expert's knowledge is broad and deep enough the process by which he arrives at his result is very much akin to the method which the theoretical statistician would use to obtain the true average were he in possession of all the facts. It is a rough and ready method of obtaining the truth, but is open to the objection that it furnishes no material by which to judge the accuracy of the method. The raw material of the average is stored away in the brain of the expert, and he, perhaps, is dead. Of late years both statisticians and economists have grown suspicious of these "average wages" statements and have demanded something better. Yet for the past we are often forced to accept material which we would reject if it applied to the present. Whether for this or other reasons such statements of average wages are frequently accepted as valid. Of such a character are the figures upon which Mr. Giffen based his well-known essay on the "Improvement of the Working Classes."¹ The more detailed and careful work of Mr. Bowley is based upon the same material. Of like nature is the work of the late Joseph D. Weeks of which a large amount is published in the twentieth volume of the Tenth Census. His work for the Aldrich Committee was of a like character and was not therefore given any prominence in the report. Much of the early work of labor bureaus in the United States had no other foundation.

Midway between the statements of experts and real enumerations of wages stand such figures for average wages as are based upon an average of rates. This is a simple device but not very trustworthy. If in a given occupation we find

¹ "Essays in Finance," Second Series.

some men gaining two dollars a day and others one dollar the average wages may be one dollar and a half, but only on the supposition that an equal number is employed at each rate. How often calculations of this nature find their way into the statements of those whom we have agreed to call experts cannot be known, but it is suspected that they are not infrequent, and this suspicion only adds to the disfavor which greets such general statements of average wages.

In the second place we possess wage statistics based upon partial enumerations. The enumeration is always partial as to the occupation, and it is frequently partial as to the locality. In the last issue of these *Publications* Mr. Bullock calls attention to the partial enumeration of the various industries represented in the Aldrich Report, and he also calls attention to the fact that while the report purports to give the course of wages in the United States, all its figures are drawn from States north of the Potomac and east of the Ohio. Statements of a similar nature with respect to the number enumerated in any given occupation and the limited geographical range of the figures would hold true in a greater or less degree in all wage statistics. The highly prized work of the United States Department of Labor, which has been the model for labor statistics the world over, has based all its reports as to wages upon partial enumerations. It is a matter of common agreement that the larger the proportion of persons employed, who are represented in the statistics, the more credence attaches to the results. When one set of wage statistics are commended in contrast to another it is generally because they rest upon a broader basis. From a theoretical point of view they all fail to meet the strict requirements of statistics, and yet we do not hesitate to use them or pass judgment upon their value. What then is the nature of this judgment, and upon what basis does it rest?

Our judgment of wage statistics rests entirely upon our appreciation of conformity to law. The average wage in an occupation is the point towards which all wages tend. If

absolutely free competition fixed wages, if custom had nothing to do with the fixation of rates, we should find within the range of wages an infinite number of gradations. Those which approached the maximum and those which approached the minimum would be relatively few in number. Those which approached the average would be far more numerous. Custom and convenience fix wage rates in round numbers¹ and prevent our having as many gradations as the range would permit. None the less, within a given occupation an economic law, which is universally recognized, tends to bring all wage payments to a level. It is on this law that we rely when we attempt by statistical short-cuts to establish average wages. If such a law exists we may deduce from it two corollaries, namely, that a large number of observations, even if it falls far short of the total number of cases, will contain the average so much more frequently than the variations from it that its average may be deemed the average of the whole; and, secondly, that the wages paid under normal conditions will conform to the average.

Upon these two corollaries all actual statistics of wages rest. As to which of these is the safest basis of operations, where both are available, there cannot be a minute's hesitation. The first is largely mechanical in its workings. Every increase of the field of observation narrows the probability of an undue proportion of abnormal cases. Yet even here the second rule is applied as a precaution. If, for instance, we wish to find wages today in the iron industry we would not seek out the charcoal furnaces, even though among them we might collect a goodly number of quotations. So that in a limited enumeration based on as many quotations as are obtainable we instinctively look for normal conditions or representative establishments.

The difficulty of determining beyond question that conditions are "normal," and that the establishment is in fact

¹ "Round Numbers in Wages and Prices," by E. D. Jones, vol. v, p. 111, of these *Publications*.

"representative," makes us dubious of all wage statistics based on a very limited observation. None the less it must be evident that our whole effort is to obtain normal wages and to eliminate the abnormal. Two ways stand open to us; first, to so increase our observations as to throw possible abnormal rates into the background; second, to assure ourselves that the wages recorded are paid under normal conditions. Theoretically both methods are unobjectionable; practically the uncertainty of the criteria of normal conditions militates against the second method.

Are the objections to the second method such as to cause us to discard it absolutely? I think not. Cautious as we must be in its application we may rest assured that in default of better methods it will be applied. We may justly criticise its use when other methods are available. But under certain circumstances it is the best that can be done. This is especially true of all wage statistics that reach back any distance into the past. For such investigations we must take material which has been saved in the course of time and be grateful. If we are to deem all such records sporadic and abnormal they become useless, and the historical investigation of wages becomes impossible.

It may be noted that with respect to localities the idea of "representative" conditions is applied very generally and evokes no criticism. If we seek the wages of textile workers in Massachusetts we go to Lawrence, Lowell, and Fall River rather than to other localities.

The second point to which the statistical inquiry has been directed has been to the course of wages. The question assumes a different aspect as it relates (1) to the wages of a specific occupation, (2) to the wages of a given industry, (3) to the general course of wages.

In the determination of the course of wages in a given occupation there could be no question if the wages at different epochs had been determined by the theoretically correct statistical method, which, however, is never the case. As

generally some substitute for the true method has been used, it is obviously important that in each determination of wages it shall have been the same substitute. It is probable that each substitute has its own law of variation from the true average. In forming a series it seems, therefore, essential that the same methods be employed for each member. In practice, therefore, one is confronted with the question whether in the absence of a continuous series one shall take such material as is available or create a new series. The Aldrich Report chose the latter method. It took a given occupation in establishments which had been in existence for a long series of years. This required a strong emphasis on the "representative" character of the establishments, which has given rise to criticism in some quarters. This criticism is partially disarmed when it is remembered that the purpose of the report was not to discover actual wages so much as their ratios and direction of change in the period covered.

The other alternative is to take the scattered notices of wages which can be gathered together and to weld them into a continuous series. This has been done very adroitly for England by Mr. Bowley. His material was very ample but very heterogeneous. He carefully avoided comparing one locality with another. If his series of wages consisted of 1860, London; 1870, London and Norfolk; 1880, Norfolk, he adopted the expedient of establishing the ratio of change of London in 1870 as compared with 1860, and using the index thus obtained for 1870 to compare Norfolk in 1870 with 1880.¹ In few countries are the existing materials sufficiently ample to permit the use of such a method. His calculations deal with statements of average wages derived from like sources for each comparison.

The investigation of the course of wages in an industry offers again no difficulty when the theoretical requirements

¹ Mr. Bowley's method received high praise at the meeting of the Royal Statistical Society at which his paper was presented, June, 1895. A very similar process applied to prices will be found in the Aldrich Report, vol. i, p. 81.

of wage statistics are fully met. But, as we have said before, this is a condition which is not found in actual statistics. The actual course of wages in a given industry is the resultant of two forces,—changes in rates paid particular occupations, and a shifting in the relative strength of the different occupations within an industry. In actual statistics it will generally be found that at the best the available data give but a few of the occupations which the industry represents, and that in the absence of good industrial statistics in the past we know nothing very positive about the relative importance of the occupations. If we then attempt to ascertain the course of wages in a given industry it must be with a full consciousness of the limitations which the conditions impose. We have nowhere a full and complete statement of the wages of all classes of occupations within the industry but only of a portion of them. If we cannot accept these as representative then the determination of the course of wages within an industry becomes impossible.

If there is so much reasonable doubt whether the course of wages in a single industry can be even approximately indicated, it would seem impracticable to obtain any notion of the general course of wages. Yet this problem is in reality simpler than the foregoing.

We must at the outset understand that in the actual condition of statistics any attempt to discover the course of average wages is out of the question. It is not a statistical impossibility had proper records been made in the past. In the absence of such records we have no means of ascertaining the average wages of all wage earners. How then shall we attempt to combine such partial information as we possess?

If we are to succeed in this effort we must borrow a device from the technique of price statistics,—the scheme of index numbers. This method of computation has established itself so firmly in price statistics that it is rarely questioned in that field. Its purpose and method is so thoroughly familiar that it needs little explanation. It aims to secure not the

variation of average prices, but the average variations of prices.¹ Its method is commonly described as reducing several series of actual prices to relative prices by taking a certain base line, a year or a period of years, for each series, making the base equal one hundred in each series and subsequent prices in each series proportions of one hundred, and then combining these relative price series into a single expression. It might be explained in another way. It might be said that at the basic period one hundred dollars or marks, or any other denomination of money, would buy a certain quantity of a certain class of goods. The quantity may not be determined, but in the other years we find the sum of money necessary to buy the same quantity of these goods. The same idea might be applied to each series. Our result for the well-known Economist Index Number might then be expressed in this form: What was at the basic period the equivalent of £2200 worth of certain goods, each being represented in the sum of £100 worth, could be purchased at a later period for say £1900.

This explains the simplest form of the price indices for a series of goods as exemplified in the Economist Index Number. The reduction of this sum to an average by dividing by the number of quotations has no other purpose than to make the final result easily comparable to a convenient base,—one hundred. More complex forms of index numbers seek to find a measure of the relative proportions of the different commodities in exchange, and thus approach the idea of the total prices paid for the articles included in the investigation.²

¹ Mr. A. L. Bowley, an unfriendly critic of the Aldrich Report in its treatment of wages, understands its method perfectly when he speaks of "Average Change" as "the quantity evaluated in the American report."—"Wages in the United States and Great Britain," *Economic Journal*, September, 1895.

² There is in this something of an approach to an average price, if understood in the following manner:—A dealer buys a series of commodities; A measured in gallons, B measured in barrels, and C measured in pounds. While an average price for the three commodities cannot be calculated, we can assume that xA , yB , zC each cost one hundred dollars, and that he buys xA , $2yB$, and $3zC$. Now if at a later period xA costs \$105, yB \$95, and zC \$90, and he continues to buy the same quantities, his total price becomes \$565 instead of \$600. The average price for what was formerly \$100 worth of goods has fallen to \$94.25.

It would appear that these complex forms had a justification which must theoretically be denied to the simple average. This theoretical superiority of the complex forms would be of practical importance if there were no such things as "general movements of prices." If each article followed its own law of variation then it would, indeed, be true that we must give greater weight in estimating changes in price levels to a rise in the price of wheat than a fall in the price of nutmegs. If each article in its price movements was a law unto itself, not only would this be necessary but our index numbers must be far more comprehensive than any which exist.

It has been frequently pointed that the various index numbers show a remarkable agreement, and that different methods of calculation on the basis of the same figures bring results which are surprisingly close.¹ This should not be a matter of wonderment, for it is only a confirmation of what index numbers are designed to show, namely, that there are such things as general price movements.² If an absolutely uniform law governed prices the matter would be plain. If for a series of articles, *A*, *B*, *C*, and *D*, the prices in a given year were 75, as compared with 100 at a previous period, no importance which might be assigned to any one of them could make the relative price for the group any other than 75. Let us vary the proposition slightly and assume the following indices: *A*, 70; *B*, 74; *C*, 76; and *D*, 80. The simple average of these indices is 75. A system of weighting might indeed change it somewhat but could not lower it below 70 or raise it above 80. If the series showed no agreement, if *A* were 50, *B* 75, *C* 100, and *D* 150, one could not tell whether prices has risen or fallen without knowing the sig-

¹ Professor F. W. Taussig, "Results of Recent Investigations on Prices in the United States."—*Yale Review*, November, 1893, p. 238.

² Those who are sceptical with regard to index numbers always seem to me to forget more or less that there must be at any moment "a general level of prices." Professor A. Beaunjon of Amsterdam, *Bulletin de l'Institut International de statistique*, 1887, vol. ii, p. 108.

nificance to be attached to the articles. But if these are representative articles of commerce, and there be any general laws governing prices, the last contingency will not arise. The second is far more probable. In times of great economic revolutions it is possible for different classes of articles to vary in different ratios or different directions. In the period 1840–1860 the Aldrich Report showed a marked decline in prices of manufactured products combined with rising prices of food products. But such contrasts are rare; the general rule is variation in the same direction. Moreover, it is to be noted that the quotations of prices usually available for these comparisons are those of the more common commodities, which are subject to the general conditions of the market and reflect its changes.

The application of index-number methods to wages was to my knowledge first attempted in the Aldrich Report, though the suggestion occurs earlier.¹ The method has not yet obtained, perhaps, general recognition in this field, and it has seemed desirable to explain its purpose and operation in a field of statistics where it has obtained a firm footing. What then has been established? Simply this, that inasmuch as prices are subject to general laws the average of price variations is an indication of the course of prices. From the great mass of prices we select a few samples. We find how these sample prices have varied, and we thus find out how all prices vary.

If wages, like prices, are governed by general laws, why should not similar methods be applicable to them? If we can select from the great mass of wages paid a sufficient number of samples, their variation can be assumed to be the variation of wages in general. The question is only as to

¹ In a report to the International Statistical Institute, May 13, 1887, Mr. Robert Giffen, speaking of wages as connected with index numbers, urges that they be considered, adding, "I am disposed to recommend by preference a separate index number, as the price of labor is to be contrasted rather than compared with the prices of commodities." *Bulletin de l'Institut International de Statistique*, vol. ii, 1887, p. 131.

the sufficient number of samples. In the broad field of general wages it is possible to secure such a sufficient number. In the narrower field of an individual industry it may not be possible. Moreover, it must be recognized that a single industry may have a law of variation distinct from the general tendencies. Its higher paid men may be crowded out into other employments, and its lower grades retained. Moreover, it should again be noted that the available wage records will apply in the main to those categories of workmen who represent the general tendencies of the labor market. For it is clear that, other things being equal, the more numerous the occupation is represented the greater is the probability of our finding records of it.

The variety of occupations pursued among the people is perhaps even greater than the variety of commodities. Hence, we find it in practice extremely difficult to collect for a given industry a sufficient number of occupations to secure results which will be altogether satisfactory. Our scattered results, representing an occupation here and another there, are rather to be taken as samples, not so much of a particular industry as of all industry.

In passing judgment upon the results of such calculations one must, moreover, bear in mind the professed relativity of the figures. It is a familiar observation that the numerical terms in which statistics are stated leads persons to regard them as measures of absolute accuracy. Every statistician is aware that his figures in the most favorable cases represent only a high degree of probability, though in most cases a higher degree of probability than can be secured by any other method of determination. Index numbers have been adopted in the historical statement of price changes, because they have proven an acceptable way of indicating these changes. The most fanatical believer in these indices would not contend that he had found in them an absolute rule of measurement. Nor could such a claim be made for the method in

its application to wages. Here again it indicates tendencies rather than measures them. For the utilization of the available data for historical investigations of wages no better method has yet been devised.

Critics of this method have insisted that a more adequate showing could be made upon the basis of average wages. This is not to be denied, but it is contended that no satisfactory account of average wages has been or can be made for past epochs. In all attempts which have been made to compass the end, the conjectural elements are far more numerous than in the index method which has been described. The choice seems to lie between accurate materials and summary indicative methods of combination, and wholly unimpeachable methods of combination based on inadequate and conjectural materials.